HHS Public Access

Author manuscript

J Dev Stud. Author manuscript; available in PMC 2016 June 01.

Published in final edited form as:

J Dev Stud. 2015 ; 51(1): 66–79. doi:10.1080/00220388.2014.947278.

Taxes and Bribes in Uganda

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Abstract

Using data from 433 firms operating along Uganda's charcoal and timber supply chains we investigate patterns of bribe payment and tax collection between supply chain actors and government officials responsible for collecting taxes and fees. We examine the factors associated with the presence and magnitude of bribe and tax payments using a series of bivariate probit and Tobit regression models. We find empirical support for a number of hypotheses related to payments, highlighting the role of queuing, capital-at-risk, favouritism, networks, and role in the supply chain. We also find that taxes crowd-in bribery in the charcoal market.

1. Introduction

According to the United Nations, corruption adds 10% to the cost of doing business and as much as 25% to the cost of public procurement, thereby undermining business performance and diverting public resources from legitimate development aims. Although it is commonly argued that bribery serves as the "grease" to lubricate transactions, it is more frequently observed that corruption places a drag on a country's global competitiveness (Mauro, 1995; Wei, 2000). Research suggests that countries which address corruption and improve transparency and the rule of law can, over time, increase national incomes by as much as four times (Bardhan, 1997; Kaufmann, 2004; Kreutner, 2010; Rose-Ackerman, 2009). In developing countries corruption is pervasive in numerous sectors, but the forestry sector stands out as having notably high levels of corruption (Kishor & Damania, 2007) catalysed, in part, by the combination of high demand and dwindling stocks of forest resources. In addition, production quotas, under-investment in monitoring and enforcement, and limited salience of the sector in national policy discourses contribute to low levels of tax collection, despite the sector's high potential for generating tax and royalty revenues, an amount estimated at $US 5 billion per year globally (World Bank, 2002).

Bribes and taxes are similar in that they create a wedge between the actual and privately appropriated marginal product of capital (Svensson, 2005). But bribes differ from taxes in

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important ways: bribes bring no money to government coffers; they have higher transaction costs than taxes due to the uncertainty and secrecy associated with payments (Shleifer & Vishny, 1993); and they are not enforceable in court, which allows officials to renege on agreements (Boycko, Shleifer, & Vishny, 1996). Fisman and Svensson (2005) estimated the effects of bribery payments and taxes on firm growth in Uganda, concluding that bribery is a greater retardant of growth than taxes.

Empirical research on corruption is often limited by lack of data, a shortcoming we address using a novel dataset that was designed to study charcoal and timber supply chains in Uganda (see the online Appendix for an overview of the value chain structure and regulatory framework of Uganda's charcoal and timber markets). We use these data to investigate patterns of bribe and tax payments for 433 firms. Supply for both products is characterised by large numbers of small-scale producers and retailers operating at either end of the chain, and relatively small numbers of larger scale traders, transporters and wholesalers operating in the middle of the chain. Focusing on the forestry sector is especially illuminating because this sector is large, accounting for 5–6 % of Uganda's Gross Domestic Product (Bush, Nampindo, Aguti, & Plumptre, 2004; Ministry of Finance, Planning and Economic Development (MFPED), 2005) and has recently been decentralised (Jagger, 2010). In addition, forest product movements span a range of economic transactions that include legally produced and marketed products subject to taxes, licensing and fees, as well as illegally obtained products that are transported and marketed in clandestine fashion.

We focus on a set of hypotheses related to the characteristics of supply chain actors, their roles, and how these relate to the probability and size of bribe and tax payments. Our primary contribution is studying taxation and bribery simultaneously at the firm level. We systematically test a number of competing hypotheses that have arisen in the literature regarding logic of bribery in the face of taxation, namely queuing, experience, capital-at-risk, favouritism, and networks. We also leverage the feature that our data cover all actors in the supply chain to test whether role in the supply chain influences the probability of tax or bribe payment. Finally, we test the hypothesis that taxation crowds-in bribery by creating the necessary point of contact for corrupt behaviour. We add to a small but growing number of studies that consider the micro-level conditions that influence corruption, rather than cross-national studies of perceptions, institutions and policies.

2. Theoretical and Empirical Model

2.1 Probability of bribe and tax payment

Our theoretical and empirical model focuses on the incentives facing supply side actors who pay bribes and taxes. We take a number of demand side factors as fixed including: the existence of an official fee or tax, whether there is a quota on taxable production, trade or sale, the resources of officials for revenue collection, the number of officials allocated to revenue collection, and the wages paid to officials (Besley & McLaren, 1993; Gould, 1980; Wane, 2000). We acknowledge that these factors influence what motivates bribe and tax payment.

We consider bribes and taxes as costs of production. We assume supply chain actors seek to maximise profit; although firms operating within a single country and sector face similar institutions and policies, the frequency or size of bribe and tax payments may vary (Reinikka & Svensson 2006; Svensson, 2003). Our interest therefore focuses on whether the probability of paying a bribe or tax is a function of firm or individual level characteristics. It seems logical that rational supply chain actors would seek to evade bribe payment, unless the costs of getting caught are so high to the individual or firm that paying the bribe is a better strategy for minimizing costs. However, from a tax policy perspective, a reasonable view is that, in a world with transparent and fair institutional conduct, tax payments would be correlated with nothing more than the volume or value of the goods being marketed. Nevertheless, we know that structural and institutional aspects of primary commodity markets in developing countries lead supply chain actors to operate as tax evaders. These factors include production quotas set far below levels adequate to meet market demand, high financial and transaction costs of obtaining permission to harvest/transport/sell, the limited capacity of understaffed and highly decentralised officials to collect taxes, and information asymmetries about the existence and cost of taxes and fees.

We test each hypothesis for each market separately to see whether there are differences in the way that firm-level characteristics affect bribe and tax payment across commodities. Because our data for both supply chains were collected in the same districts we control for variation in meso- and macro-institutional variables as well as differences in biophysical characteristics (i.e., forest condition), and other contextual factors such as market access and population density. This allows us to focus squarely on firm-level characteristics. Finally we examine the relationship between bribes and taxes for each commodity. In a non-corrupt system, all capture would occur through tax payments and one should find no correlation between tax payments and bribes. Given that, from a tax policy point of view, all firms *ought* to be paying taxes, any correlation between taxes and bribes may be taken as *prima facia* evidence that taxes are “crowding-in” bribes. A brief synopsis of our hypotheses follows (summarised in Table 1).

The *queuing hypothesis* asserts that the number of actors operating in a market influences the probability of bribe payment. Bribe payment is a way to jump to the front of the queue moving goods further up the supply chain or to market faster. The idea that bribery might facilitate transactions was has been explored by Leff (1964) and Lui (1985). The most robust evidence exists for the transport sector in sub-Saharan Africa, suggesting that delays increase the likelihood of bribe payment (Bromley & Foltz, 2011; Freund & Rocha, 2010). Early studies on corruption found that poorly paid officials might deliberately cause administrative delays so as to attract more bribes (Kleinrock, 1967; Myrdal, 1968). We operationalise the queuing hypothesis using the number of agents competing in the sector. We expect competition in the sector to be positively correlated with bribe payment. We do not have a clear hypothesis regarding the role of competition and the payment of taxes. Competition may increase the efficiency of tax collection, making tax payment more likely, but conversely, if bribes crowd out taxes, at congested points along the value chain tax payment may be less likely.

The *experience hypothesis* reflects familiarity or understanding with the way the market operates including knowing how to maximise profits, which implicitly involves minimizing bribe and tax payments. Deininger and Mpuga (2005) show that knowledge of how to report inappropriate behaviour by public officials reduces corruption, suggesting a negative relationship between experience and bribe payment. Other things equal, industry experience should lead to greater familiarity both with official rules and with officials, reducing the tendency for individuals to "overweight" the likelihood of adverse events occurring (Alm, McClelland and Schulze 1992), thereby reducing the probability and amount of tax payments. We use number of years in business as a proxy for experience expecting a negative relationship between experience and bribe and tax payments.

The *capital-at risk hypothesis* suggests that the amount of capital held by an agent influences the probability of bribe payment. Harstad and Svensson (2011) use a dynamic growth model to examine how firms deal with regulatory constraints. They show that a firm's optimal rule is to bribe when its level of capital is small, and to switch to lobbying as it grows in size in order to avoid "hold up" of large amounts of capital. Svensson (2003, 2005) studied characteristics shared by countries with high levels of corruption examining why anti-corruption campaigns generally fail to reduce corruption, concluding that when a firm operates with a technology that has a small sunk cost component, this tends to strengthen the firm's bargaining position vis-à-vis a corrupt official, lowering the reservation bribe. This hypothesis is consistent with patterns in which bribe amounts are correlated with return to capital in alternative activities. In other words, the amount of capital "at risk" might matter to behaviour.

Given limited scope for lobbying and high sunk costs (e.g., hired labour, fuel, vehicle rental etc.) associated with firms operating in these markets, we hypothesise a positive relationship between bribe payment and capital-at-risk, which we operationalise using value of the charcoal/timber inventory held by the firm. We also expect a positive relationship between capital-at-risk and tax payment. Both charcoal and timber are bulky commodities, suggesting that high value inventories are large and therefore difficult to hide from tax collecting officials. However, gains from tax evasion for high value inventories suggest a potentially negative relationship between capital-at-risk and tax payment.

The *favouritism hypothesis* tests the influence of preferential treatment by officials on the probability of tax or bribe payment. Hindriks, Keen, and Mutho (1999) and Mookherjee and Png (1995) develop the idea that an official may possess some degree of monopoly power, and therefore may have an ability to price-discriminate among clients. Accordingly we would expect bribe payment to be negatively correlated with favouritism. In Uganda, Fjeldstad (2005) argues that kinship undermines tax reform efforts because the motives of individual actors are inextricably tied to social groups, either through ethnicity or shared interests. As for bribes, we expect favouritism to be negatively associated with tax payment.

We operationalise favouritism using two variables. The first indicates whether the individual or head of the firm is from the dominant ethnic group in the region. Given Uganda's ethnic cleavages, we expect those from the dominant group to be favoured and therefore to have a lower probability of both bribe and tax payment. The second variable allows us to test the

influence of being from a minority group (e.g., Bakiga). We expect a positive relationship between bribe and tax payment for the charcoal market. However, given the dominance of the Bakiga in the timber value chain, we may find that being from the ethnic group that dominates the value chain decreases the likelihood of both bribe and tax payment.

The *network hypothesis* asserts that an agent's social capital may influence bribery payments whereby accumulated social capital results in fewer or lower bribe payments. Conversely, evidence from the health sector in Uganda suggests that richer and better-connected patients were more likely to bribe officials (Hunt & Laszlo, 2012). Abbink, Irlenbusch, and Renner (2002) used a simple sequential game to study bribery interactions and found that reciprocity was enough to induce bribery exchanges in a repeated game, and that results were largely invariant to the magnitude of externalities for non-participants. These findings suggest an ambiguous relationship between bribe payment and social capital, which we operationalise using the number of business contacts a firm has. As with favouritism, Fjeldstad (2005) found that network effects undermine tax reform efforts. We expect favouritism to be negatively correlated with tax payment. We also consider the number of contacts with forest officials as an important indicator of a firm's network. We expect a positive relationship between both bribe and tax payment and contact with forest officials, except in cases where collusion between forest officials and agents shifts all or part of a tax to a bribe by mutual agreement. In that case we expect a negative relationship between tax payment and contacts with forest officials.

We test a sixth hypothesis focused on whether *role in the value chain* influences the probability of bribe payment. In the forestry sector, like many commodity value chains in developing countries, the beginning points of the supply chain are characterised by large numbers of small-scale producers and middle-men operating in spatially diffuse locations, while the number of traders and transporters, those that occupy the upper-mid points of the supply chain, are typically fewer, operate at larger scale, and pass through major transportation hubs en route to urban centres. Retailers are many, generally operate on a small-scale, and are frequently found in fixed locations, though in the case of charcoal markets they can be spatially diffuse. We expect a negative relationship between both bribe and tax payment for producers and middlemen. Both sectors are characterised by small-scale producers that are spatially diffuse and often operate in a clandestine manner, suggesting that forest officials with limited resources will find it difficult to locate and extract bribes from them. Further, the high transaction costs of paying taxes associated with production (e.g., transportation to the nearest District Forestry Office to obtain permission) imply a low probability of tax collection. Our expectations are the inverse for actors in the middle of the supply chain. In Indonesia, Olken and Barron (2009) used a direct observation approach in which surveyors accompanied truck drivers and recorded the frequency and amount of bribes paid to officials. They found a high incidence of bribe payment, often in tandem with payment of a tax or tariff. In developing countries where the routes for bulky commodities are limited to major transportation routes, the highest probability of extracting a bribe or a tax is from the traders and transporters that are moving large and high value loads along well-established routes.

Our expectations about bribe payment by retailers are less distinct than for the former categories, and vary according to whether we consider charcoal or timber retailers. Charcoal retailers are generally small-scale and more spatially diffuse suggesting that it is more difficult to extract bribes and taxes from them. Conversely, timber retailers are generally co-located in formal markets making tax collection easier for officials. Timber is more easily identified than charcoal as being illegal because legally produced timber is generally stamped and certified. This suggests greater opportunities for officials to extract bribes from timber merchants than charcoal agents.

2.2 Econometric specification

The online Appendix describes in detail Uganda's charcoal and timber markets, as well as our data collection procedure. We estimate parallel sets of regressions for the charcoal and timber markets, examining the probability of bribe and tax payments in each market, as well as the size of bribe and tax payments in each. In the first case, the observed mixture of tax and bribe outcomes reported in Table 2 motivates us to treat the probabilities of tax and bribe payments as seemingly unrelated regressions, which we estimate using bivariate probit models. We examine each of our hypotheses jointly in a single comprehensive model. We also control for district of operation to account for exogenous factors including the enforcement capacity of officials, the size of the area monitored by officials etc. The structure of these bivariate probit models is:

$$\begin{gathered} y^B=\alpha^{\mathrm{B}}+\mathbf{A}'\boldsymbol{\beta}^{\mathrm{B}}+\mathbf{H}'\boldsymbol{\gamma}^{\mathrm{B}}+\mathbf{D}'\boldsymbol{\delta}^{\mathrm{B}}+\mathbf{R}'\boldsymbol{\lambda}^{\mathrm{B}}+\varepsilon^{\mathrm{B}} \\ y^T=\alpha^{\mathrm{T}}+\mathbf{A}'\boldsymbol{\beta}^{\mathrm{T}}+\mathbf{H}'\boldsymbol{\gamma}^{\mathrm{T}}+\mathbf{D}'\boldsymbol{\delta}^{\mathrm{T}}+\mathbf{R}'\boldsymbol{\lambda}^{\mathrm{T}}+\varepsilon^{\mathrm{T}} \\ E(\varepsilon^B|\boldsymbol{A},\boldsymbol{H},\boldsymbol{D},\boldsymbol{R})=E(\varepsilon^T|\boldsymbol{A},\boldsymbol{H},\boldsymbol{D},\boldsymbol{R})=0 \\ V(\varepsilon^T|\boldsymbol{A},\boldsymbol{H},\boldsymbol{D},\boldsymbol{R})=V(\varepsilon^T|\boldsymbol{A},\boldsymbol{H},\boldsymbol{D},\boldsymbol{R})=1 \\ \mathrm{Cov}(\varepsilon^B,\varepsilon^T|\boldsymbol{A},\boldsymbol{H},\boldsymbol{D},\boldsymbol{R})=\rho \end{gathered} \quad (1)$$

where B indicates payment of a bribe and T indicates payment of a tax; **A** denotes a set of agent-specific controls; **H** denotes the hypothesised controls as described above; **D** indicates district-specific control variables; and **R** denotes control variables specific to the agent's role in the supply chain. We report robust standard errors which are clustered geographically at the sub-district level. Given the substantial observed differences in values between charcoal and timber, we have scaled monetary values (reported in Ugandan Shillings) by 1000 in the case of charcoal and 100,000 in the case of timber. All values are reported in Ugandan Shillings; at the time of the survey, 1 USD ≈ 1700 UgShs. Basic diagnostic tests support the assertion that estimated parameters differ significantly across the samples.

Our second series of regressions has a parallel structure and uses similar control variables, but extends the analysis to the corresponding observed level of payment. We estimate these regressions using the full set of controls employed in the bivariate probit regressions, including the district and role controls. We fit the model using a seemingly unrelated (SUR) bivariate Tobit regression (Lee, 1993) with lower truncations at zero. The SUR bivariate Tobit model in this case is given by:

$$P_B^*=\mathbf{x}^{B\prime}\boldsymbol{\theta}^B+\xi^B,\quad P_B=\max(P_B^*,0)$$
$$P_T^*=\mathbf{x}^{T\prime}\boldsymbol{\theta}^T+\xi^T,\quad P_T=\max(P_T^*,0)$$
$$E(\xi^B|\boldsymbol{x}^B)=E(\xi^T|\boldsymbol{x}^T)=0$$
$$V(\xi\varepsilon^B|\boldsymbol{x}^B)=\sigma_B^2;V(\xi^T|\boldsymbol{x}^T)=\sigma_T^2;\mathrm{Cov}(\varepsilon^B,\varepsilon^T|\boldsymbol{x}^B,\boldsymbol{x}^T)=\rho\sigma^B\sigma^T \quad (2)$$

where B indicates bribe, T indicates tax and $P\geq 0$ corresponds to the observed tax or bribe payment; **x** is the full model vector of control variables (consisting of **A**, **H**, **D** and **R** as discussed above) and θ represents a vector of parameters to be estimated. We estimate two regression models for (2), one each for the charcoal and timber samples, respectively.

3. Results

3.1 Who pays bribes and taxes?

Table 2 reports results for which actors in the supply chain pay taxes, bribes or both. For the charcoal market we find the highest incidence of tax only payment among producers (52.8%) and traders (42.7%). Bribe only payments are infrequent, except among transporters (30%). Most roles paid bribes and taxes, but the frequency of cases where both tax and bribe payments were observed for the charcoal market across all roles is relatively small (13%). The highest degree of tax and bribe complementarity is found for traders (37.8%). Relatively high complementarity is also observed among retailers (22.2%). Middlemen appear to have the most limited experience with paying taxes or bribes; 93% reported they paid neither. At least half of retailers and transporters also reported paying neither taxes nor bribes.

A significant share of retailers, transporters, and producers in the timber market reported paying only taxes (60%, 48% and 38% respectively). Payment of only bribes was relatively low across all categories (7%), and was concentrated at the lower end of the supply chain. We find a relatively high degree of complementarity between tax and bribe payment for traders (53%), and to a lesser extent for retailers and transporters. Complementarity of taxes and bribes suggests that taxes may be crowding-in bribes at numerous points along the supply chain. Overall, one quarter of the timber sample reported paying taxes and bribes, suggesting substantial complementarity between payments. As with the charcoal market, middlemen are largely exempt from paying taxes or bribes; 95% reported paying neither. However, a much lower share of the overall sample of actors in the timber market paid neither compared to the charcoal market.

One might reasonably ask how much taxes and bribes add to the cost of doing business. Reported amounts, on average, do not constitute a large proportion of total costs, but in some cases amounts are substantial. Taxes constitute 8.8% of gross margins, on average for charcoal (maximum 77%) and 4.1% of gross margins (maximum 81%) for timber. Reported bribes represent 1.2% of gross margins on average (maximum 46%) for charcoal and 2.0% (maximum 81%) for timber. For the timber market, in particular, our calculations suggest that a substantial amount of scheduled tax revenue is not being captured for the public purse. If one considers only the timber handled by traders—who, by law, should be paying 30% of the estimated value of that timber as taxes—we calculate that districts should have collected

approximately 160 million UgShs (about $100,000 USD) in revenue from the transactions we observe. However, our estimate of actual taxes paid is only 7.7% of that expected value.

3.2 Testing hypotheses regarding who pays bribes and taxes

(i) Charcoal supply chain—For charcoal firms we find support for the queuing hypothesis with a weakly significant and positive relationship between competition and probability of paying tax (Table 3). This suggests that revenue collection through taxation benefits from a high density of firms, and that forest officials may position themselves at economic choke points. In a highly diffuse market, with many small firms spread across a large geographic region, this result is consistent with the goal of obtaining maximum public revenue under collection constraints.

We find a positive and significant relationship between inventory value (capital-at-risk) and the probability of both bribe and tax payment. The positive relationship between value of inventory and probability of bribe payment suggests that firms that face losses from “hold up” are more likely to pay bribes. Because charcoal taxes are volume based, it is not surprising that we find a positive and significant relationship between capital-at-risk and tax payment. One might expect rational and honest forest officials to focus their attention on firms with large inventories in order to maximise tax revenues. This largely reflects a pattern in the data in which traders carry large inventories (51,378 UgShs on average, vs. 12,109 UgShs for non-traders), making them especially visible and remunerative targets for collection. As a result, they are much more likely to pay taxes (89% vs. 49% for non-traders).

With respect to favouritism we find a statistically weak negative relationship between bribe payment and whether the firm or agent is from the dominant ethnic group. However, this relationship is not robust when we control for district of operation. We find strong statistical support for the network hypothesis. The likelihood of paying a bribe in the charcoal market increases with the number of forest official contacts. This finding is supported by the literature on decentralised vs. centralised corruption which asserts that spatially diffuse public officials with limited oversight are more likely to engage in corrupt behaviour (Fisman & Gatti, 2002; Prud’homme, 1995; Shah, 2006). Moreover, the variables are jointly significant in the bribery regressions. However, business contacts and contacts with forest officials do not appear to be strongly correlated (either individually or jointly) with the likelihood of paying taxes. We do find that traders and transporters are less likely to pay taxes than producers, suggesting these agents are finding a way to evade officials.

(ii) Timber supply chain—For timber (Table 4) we find a consistently negative and statistically significant relationship between the number of firms in the market and the payment of both bribes and taxes. These findings are robust to the alternative specification that controls for district of operation. We have two potential explanations to support the presence of a large number of firms being negatively associated with payment of a bribe: first, large numbers of firms decrease the importance of any single bribe for an official; second, as the number of firms rises, the probability that any one firm will incur a bribe payment falls where there are too few forest officials to monitor and enforce rules. Both

explanations apply to the timber value chain. Forest officials who are motivated to extract bribes to supplement their modest salaries must do so in a manner that does not attract too much attention, and the ratio of forest officials to timber firms is very low. We also find a negative relationship between number of firms in a market and tax payment. The negative relationship between number of firms and tax payments suggests that there are too few officials to collect taxes, and that tax collection is inefficient.

We find a positive, significant, and robust relationship between number of years in business and tax payment (experience). This finding is somewhat surprising given (a) the high level of illegal activity in the timber market, and (b) the low levels of reporting of revenue collection by district governments. This finding might reflect more experienced timber firms obtaining legal permission to harvest timber, meaning that they must pay for permits and volume/value based taxes. Another potential explanation is that more experienced firms pay taxes in the hope of limiting bribe payments.

Size of inventory is negatively and significantly correlated with bribe payments for timber firms, which suggests preferential treatment of larger-scale agents. We find a positive and significant relationship between size of inventory and tax payments. This finding is consistent with our findings for the charcoal sector. Like charcoal, taxation is volume based, meaning that public officials with scarce time and resources can extract larger tax revenues by focusing on large firms.

We find a negative and significant relationship between dominant ethnicity and payments in the timber sector (favouritism). We also find that firms headed by Bakiga are more likely to pay bribes or taxes than non-Bakiga firms, further supporting the favouritism hypothesis. We find that Bakiga firms and firms led by the dominant ethnic group are more likely to pay taxes suggest an egalitarian approach to tax collection that is not observed for bribes. We find a positive, weakly significant relationship between number of business contacts and contacts with forestry officials and both bribe and tax payments. These findings are not robust to the inclusion of district level dummy variables.

Turning to the issue of whether taxes might be promoting bribery, we note that the simple product moment correlation between two binary outcomes, in this case “paid tax” and “paid bribe” is not an appropriate measure of underlying correlation (Greene, 2008). However, the bivariate probit models provide, as a by-product, the correct, tetrachoric correlations between these outcomes. These range from 0.22 to 0.33 for the charcoal data and from 0.09 to 0.31 for timber. For charcoal, all are weakly significantly different from zero. These patterns are broadly suggestive of a positive relationship between taxes and bribes, and substantially undermine the possibility that bribes are serving as a substitute for tax payments. We note, however, that our method of measuring this relationship has limitations. First, our data represent aggregated tax and bribe payments during a month of operation, rather than single episodes of exchange. As a result, we cannot directly correlate specific instances in which an agent paid a combination of a tax and a bribe simultaneously to a single official. Second, even if we could observe such pairings, outcomes would undoubtedly be jointly determined, which would frustrate any effort to untangle the exogenous effect of tax collection on bribe payment.

3.3 What influences the size of tax payments and bribes?

Beyond understanding what determines who pays taxes and bribes, we are interested in the factors that influence the size of bribes and taxes paid. We estimate a parallel set of seemingly unrelated bivariate Tobit regression models to explore which of our hypothesised explanations for bribe payment influence the amount paid (Table 5). Our interest here is on the overall amount of bribes and taxes paid in the sample and the correlation between observed variables on these amounts. We note that the interdependence of bribes and taxes can be tested using both a likelihood ratio test and a *t*-test. Both tests rely on the feature that when the paired models are estimated in a univariate setting the correlation coefficient for the errors of the two equations is equal to 0 by construction. Details of the tests are described in a note to Table 5. We conclude in both cases that bivariate treatment of the data is justified.

In the charcoal regressions we find a large number of variables to be correlated with bribe levels. With only one exception, the signs of the correlations between variables and bribe amounts are the same as the signs of the correlations between variables and the probability of paying a bribe. The exception is capital-at-risk, which is positively correlated with the probability of paying a bribe, but negatively correlated with the bribe amount. An additional agent competing in the market raises the monthly bribe amount by 1,930 UgShs, or roughly 22% of the average monthly bribe of 8,600 UgShs. Those from the dominant ethnic group pay 18,467 UgShs less per month – equivalent to roughly half the standard deviation for the distribution of payments observed in the sample. The ethnicity variables are individually and jointly significant. Similarly both business and forest official contacts are individually and jointly significant, and positively correlated with the level of bribes paid in the charcoal market. This suggests that high levels of activity are associated with bribes. A surprisingly large number of factors are correlated with the level of taxes paid in the charcoal market. Competition, inventories, Bakiga ethnicity and business contacts are all positively and significantly correlated with tax payments at standard test levels.

In the timber market, the size of bribe payments has surprisingly few strong determinants. We find a negative and significant correlation between the size of bribe paid and competition in the market; the larger the number of agents operating a given area the lower the bribe payment extracted, perhaps because officials have a larger pool from which to extract bribes. An additional agent competing in the market reduces the monthly bribe amount by 4,730 UgShs, or roughly 23% of the average monthly bribe of 20,100 UgShs. We also find that agents from the dominant ethnic group are likely to make smaller bribe payments. Several factors influence the size of tax payments in timber markets. Those with more experience, larger inventories and bigger networks pay higher taxes, as do transporters, suggesting that the size of tax payments in the timber sector are largely subjective.

4. Conclusions

We examined patterns of bribery in the context of charcoal and timber markets, two of the most highly valued and widely marketed forest products in the developing world. We tested a number of hypotheses emanating from the literature to provide insights into underlying

causes of corruption, and by extension, what programs and policies might be appropriate for addressing corruption in developing countries.

Correlations obtained from bivariate probit regressions confirm strong complementarities between taxes and bribes in the charcoal market, but not the timber market. For the charcoal market we find support for favouritism, capital-at-risk and networks as determinants of whether firms pay bribes. These findings point to two main conclusions. First we find a bias in who pay bribes to forest officials. Firms owned by ethnic minorities are more likely to pay bribes and to pay larger bribes, on average, than others in the sample. Second, contact with forest officials leads to increases in the likelihood of bribe payment. This is a challenging finding in a policy environment where decentralised monitoring, enforcement and tax collection is encouraged. Our results suggest that more officials on the ground will result in more bribe payments. Many of these same factors, (including competition, capital-at-risk, ethnicity and networks) also influence the size of taxes paid. Tax payment in the charcoal sector is positively correlated with the number of firms in the market and the number of network contacts. The implication is that forest officials may be locating themselves strategically to minimise the costs of revenue collection. Overall, for the charcoal market, taxes seem to be less influenced than bribes by observable factors. This provides some support for the idea that taxes are being collected in a fairly objective manner.

For the timber market we find support for queuing, capital-at-risk and favouritism. Larger numbers of firms competing within a market decreases the likelihood and size of bribe payment. This supports the assertion that when there are a large number of firms the marginal gains associated with each additional bribe payment diminish. Capital-at-risk is negatively associated with bribe payment suggesting that larger-scale firms are less likely to pay bribes. However these firms tend to pay higher taxes. The size of bribe payments in the timber market has few clear determinants. We find that competition has a negative effect on the size of bribe payments. Dominant group ethnicity is negatively correlated with tax payments. As expected, size of inventory is positively correlated with the amount of taxes paid.

Our findings support Shah and Schacter (2004) who suggest that one drawback of decentralization is the creation of numerous new public authorities, each with the power to tax, regulate, and—in the context of our sample—engage in corrupt behaviour. In Uganda, most anticorruption agencies have been ineffective, largely because governance is weak. One exception has been Uganda’s experiment with publishing data on government expenditures related to service delivery. For example, Reinikka and Svensson (2005) used a newspaper campaign to provide parents with information on how to monitor school officials’ handling of public grant programs. Their evidence shows that greater public monitoring of public official activity reduced corruption among public officials. A similar campaign to make more transparent expected levels of tax collection, especially with respect to timber trade, could generate better compliance.

We acknowledge several important limitations of our study. First, we do not observe transaction-specific pairings of taxes and bribes, nor repeated contacts between specific agents and officials. Instead we observe reported monthly costs of doing business, which

may reflect aggregation across multiple interactions and therefore mask incentives and behaviours that are influenced by ongoing relationships. This limits our ability to draw a strong link between the behavioural mechanisms that connect the presence of taxes and the solicitation of bribes. In this sense, we are unable to determine conclusively whether forest officials extract bribes instead of taxes, or whether they combine bribes with taxes. Second, we remain silent on the welfare effects of the observed phenomena. Transfers are occurring between agents, and government receipts are lower than the rules would otherwise dictate, but we cannot easily ascertain the frictions and deadweight losses associated with observed patterns. Third, we rely on self-reporting of taxes and bribes by firms whose activities are often illegal; hence our estimates of taxes and bribes are likely lower bound estimates of true values.

The robustness (or lack thereof) of our findings across the charcoal and timber markets is of interest. For the case of bribes we find that being from the dominant ethnic group (favouritism) is negatively and significantly associated with bribe payment and size in both the charcoal and timber markets. For taxes, as expected we find that capital-at-risk is positively and significantly correlated with tax payment for both charcoal and timber. For the remaining hypotheses we either have inconclusive, or in some cases statistically significant and conflicting signs across the two markets, for example, our consideration of the relationships between bribe payment and capital-at-risk, and tax payment and queuing. Despite similar market structures and regulatory frameworks, we posit that the differing scales of activity and vested interests in each market may be influencing our results. Timber is a much higher value commodity than charcoal and thus subject to a substantially different set of incentives and interests for both agents and officials. We also acknowledge that self-reported categorization of bribes and taxes by respondents may be responsible for miss-categorizing bribes and taxes which might explain some of the differences between these markets in the findings.

Although substantial challenges confront researchers who wish to collect micro-level evidence on corruption (Reinikka & Svensson, 2006) our experience suggests that it is possible. Efforts directed at bringing clandestine and illegal behaviour under the lens of researchers may ultimately pay dividends by exposing the extent and magnitude of illegal activity, thereby making it harder for policy makers to accept or ignore this behaviour.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This research was made possible through support provided by the Bureau of Economic Growth, Agriculture and Trade, U.S. Agency for International Development through the BASIS Assets and Market Access Collaborative Research Support Program; the Centre for International Forestry Research (CIFOR); the Collective Action and Property Rights Initiative (CAPRi) of the Consultative Group on International Agricultural Research; the National Science Foundation (NSF, grant number DDIG 0622392); the Social Sciences and Humanities Research Council of Canada (SSHRC); the Social Science Research Council (SSRC); and the Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program (SANREM CRSP, grant number EPP-A-00-04-00013-00). We are grateful to the Carolina Population Centre (R24 HD050924) at The University of North Carolina at Chapel Hill for general support. The opinions expressed herein are those of the authors and do not

necessarily reflect the views of the sponsoring agencies. For assistance and advice of various forms we thank Arild Angelsen, Arthur Arinaitwe, Michael Delgado, David Guilkey, Fydess Khundi, Benjamin Mason-Meier, Jeff Michler, Jeremy Moulton, Lauren Persha, Jake Ricker-Gilbert, Samuel Sellers and Dick Sserunkuuma. We are grateful to two anonymous reviewers for providing comments that greatly improved our manuscript. Data and associated coding are available upon request from Dr. Pamela Jagger pjagger@unc.edu.

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Table 1

Hypothesised determinants of bribe and tax payment and expected signs

	Bribe	Tax
Queuing (# agents in competition)	+	+/−
Experience (# years in business)	–	–
Capital-at-risk (inventory value)	+	+/−
Favouritism (dominant ethnic group)	–	–
Favouritism (Bakiga ethnic group)	+/−	+/−
Networks (business contacts)	+/−	–
Networks (forest official contacts)	+	+/−
Role (start of value chain e.g., producer, middleman)	–	–
Role (middle of chain e.g., transporter, trader)	+	+
Role (end of chain e.g. retailer)	+/−	+/−

Table 2

Frequency of taxes and bribes paid, by role (percentage)

Role	Charcoal market[1]				
	N	Neither	Tax only	Bribe only	Both
Producer	36	19.4	52.8	5.6	22.2
Middleman	45	93.3	0.0	6.7	0.0
Transporter	60	50.0	15.0	30.0	5.0
Trader	82	15.9	42.7	3.7	37.8
Retailer	225	57.3	33.3	2.8	6.7
All	448	49.3	30.8	7.1	12.7

	Timber market[2]				
	N	Neither	Tax only	Bribe only	Both
Producer	189	31.7	38.1	9.5	20.6
Middleman	21	95.2	0.0	4.8	0
Transporter	48	14.6	47.9	8.3	29.2
Trader	17	23.5	23.5	0	53.0
Retailer	122	4.1	59.8	2.5	33.6
All	397	24.2	43.3	6.5	25.9

[1]Wholesalers are grouped with traders.

[2]Wholesalers are grouped with retailers.

Table 3

Seemingly unrelated bivariate probit regression results for incidence of bribes and taxes in the charcoal market: dependent variable is bribe/tax paid (0/1)[1,2]

	Bribe Paid		Tax Paid	
	Base model	**Model with District FE**	**Base model**	**Model with District FE**
Queuing (# agents competing in market)	−0.004 (0.005)	−0.003 (0.005)	0.012* (0.007)	0.012* (0.007)
Experience (# years in business)	0.003 (0.024)	0.002 (0.023)	−0.029 (0.026)	−0.029 (0.026)
Capital-at-risk[3] (Inventory value in UgShs)	0.008*** (0.003)	0.007*** (0.002)	0.014* (0.008)	0.014* (0.008)
Favouritism (dominant ethnicity) (0=No, 1=Yes)	−0.197* (0.172)	−0.216 (0.169)	0.101 (0.172)	0.099 (0.177)
Favouritism (Bakiga ethnicity) (0=No, 1=Yes)	0.593 (0.547)	0.462 (0.524)	0.706 (0.718)	0.695 (0.720)
Networks (business contacts) (# relations >1 year)	0.005 (0.010)	0.005 (0.010)	0.009 (0.009)	0.009 (0.008)
Networks (forest official contacts) (total # of contacts)	0.009*** (0.003)	0.008*** (0.003)	0.002 (0.003)	0.001 (0.003)
Role, Trader c.f. producer)	−0.416 (0.400)	−0.511 (0.421)	−0.747** (0.365)	−0.756** (0.365)
Role, Transporter (c.f. producer)	0.146 (0.409)	0.030 (0.471)	−1.103* (0.599)	−1.109* (0.599)
Role, Retailer (c.f. producer)	−0.474 (0.395)	−0.526 (0.423)	−0.301 (0.356)	−0.308 (0.355)
Age (years)	0.010 (0.014)	0.010 (0.014)	−0.004 (0.017)	−0.004 (0.016)
Education (years of formal)	0.102*** (0.030)	0.105*** (0.030)	0.022 (0.024)	0.023 (0.024)
Gender (0=Male, 1=Female)	−0.868*** (0.217)	−0.977*** (0.220)	−0.475** (0.243)	−0.515** (0.250)
Constant	−1.623** (0.507)	−1.474** (0.680)	0.490 (0.767)	0.599 (0.869)
N	448	448		
Log-likelihood	−426.4	−422.9		
Corr(bribe,tax)	0.32	0.31		
χ^2 for ρ(bribe,tax)	6.78	6.34		

[1] Robust standard errors clustered at the sub-district level (n=71) are presented in parentheses.

[2] *** Significantly different from zero at the 1% test level; ** 5% level; * 10% level.

[3] Inventory values are measured in 1,000s

Table 4

Seemingly unrelated bivariate probit regression results for incidence of bribes and taxes in the timber market: dependent variable is bribe/tax paid (0/1)[1,2]

	Paid Bribe		Paid Tax	
	Base model	**Model with District FE**	**Base model**	**Model with District FE**
Queuing (# agents competing in market)	−0.004*** (0.001)	−0.004*** (0.001)	−0.004*** (0.001)	−0.003*** (0.001)
Experience (# years in business)	−0.013 (0.022)	−0.014 (0.023)	0.061** (0.029)	0.058** (0.026)
Capital-at-risk[3] (Inventory value in UgShs)	−0.006** (0.003)	−0.007** (0.003)	0.062** (0.024)	0.058*** (0.022)
Favouritism (dominant ethnicity) (0=No, 1=Yes)	−0.088 (0.199)	−0.145 (0.207)	0.014 (0.245)	−0.228 (0.239)
Favouritism (Bakiga ethnicity) (0=No, 1=Yes)	0.473*** (0.135)	0.366** (0.154)	0.816** (0.354)	0.693** (0.322)
Networks (business contacts) (# relations >1 year)	0.017* (0.010)	0.011 (0.010)	0.038* (0.040)	0.033 (0.044)
Networks (forest official contacts) (total # of contacts)	0.003 (0.006)	0.002 (0.006)	−0.001 (0.006)	0.000 (0.006)
Role, Middle man (c.f. producer)	−1.593*** (0.545)	−1.656*** (0.543)	−7.657*** (1.106)	−8.017*** (1.391)
Role, Trader c.f. producer)	0.115 (0.245)	−0.051 (0.250)	0.765 (0.727)	0.690 (0.535)
Role, Transporter (c.f. producer)	0.116 (0.337)	0.043 (0.318)	0.0147 (0.367)	0.152 (0.410)
Role, Retailer (c.f. producer)	−0.023 (0.187)	−0.070 (0.170)	1.277*** (0.425)	0.883** (0.442)
Age (years)	−0.028** (0.014)	−0.028* (0.014)	−0.007 (0.012)	−0.006 (0.014)
Education (years of formal)	−0.009 (0.029)	−0.017 (0.029)	0.047 (0.042)	0.061 (0.050)
Gender (0=Male, 1=Female)	0.463* (0.273)	0.458* (0.266)	0.287 (0.367)	0015 (0.455)
Constant	0.436 (0.441)	0.485 (0.564)	−0.715 (0.538)	0.413 (0.708)
N	397	397		
Log-likelihood	−367.79	−339.65		
Corr(bribe,tax)	0.09	0.12		
χ^2 for ρ(bribe,tax)	0.138	0.138		

[1] Robust standard errors clustered at the sub-district level (n=71) are presented in parentheses.

[2] *** Significantly different from zero at the 1% test level; ** 5% level; * 10% level.

[3] Inventory values are measured in 100,000s.

Table 5

Bivariate Tobit regression results for bribes and taxes: dependent variable is amount of bribe or tax paid (UgShs/1000)[1,2]

	Charcoal market		Timber market	
	Bribe	**Tax**	**Bribe**	**Tax**
Queuing (# agents competing in market)	0.193 (0.298)	0.941** (0.430)	−0.473*** (0.133)	−0.065 (0.250)
Experience (# years in business)	0.528 (1.352)	0.396 (1.993)	−0.580 (1.568)	13.967*** (3.343)
Capital-at-risk[3] (Inventory value in UgShs)	0.162* (0.084)	0.462*** (0.151)	−0.412 (0.441	3.415*** (0.745)
Favouritism (dominant ethnicity) (0=No, 1=Yes)	−18.467* (10.360)	15.793 (14.995)	−42.374* (25.075)	−81.572 (59.820
Favouritism (Bakiga ethnicity) (0=No, 1=Yes)	19.545 (31.477)	122.510** (52.829)	23.761 (23.905)	−15.340 (56.134)
Networks (business contacts) (# relations >1 year)	0.916** (0.349)	2.183*** (0.633)	−0.031 (1.409)	−2.233 (3.046)
Networks (forest official contacts) (total # of contacts)	0.600*** (0.145)	0.492** (0.229)	0.245 (0.407)	4.550*** (0.915)
Role, Trader[4] (c.f. producer)	−1.066 (20.580)	−162.210*** (36.624)	−53.730* (31.988	−66.712 (83.130)
Role, Transporter (c.f. producer)	−21.762 (18.893)	−67.776** (29.923)	−37.772 (29.043)	180.864*** (66.153)
Role, Retailer (c.f. producer)	−29.043 (18.988)	−46.323* (27.810)	−49.410** (21.895)	9.842 (49.359)
Age (years)	1.543** (0.752)	0.517 (1.047)	−3.528*** (1.087)	−7.070*** (2.626)
Education (years of formal)	6.847*** (1.435)	9.902*** (2.083)	2.991 (2.346)	12.727** (5.687)
Gender (0=Male, 1=Female)	−55.282 (14.426)	−46.413** (18.902)	41.394* (22.979)	−3.073 (53.109)
Constant	−145.825*** (38.344)	−82.558 (52.980)	37.171 (49.537)	−53.689 (114.495)
N	448		397	
Wald χ^2	90.45 (k=16)		47.43(k=20)	
σ (s.e.)	66.4*** (5.3)	134.4*** (6.2)	123.2*** (8.4)	337.2*** (14.5)
ρ (s.e.)[5]	0.58*** (0.13)		0.39*** (0.11)	

[1] Robust standard errors clustered at the sub-district level (n=71) are presented in parentheses. Models includes binary variables to control for district of operation (j=4 for charcoal regressions and j=8 for timber regressions). Diagnostic tests were conducted to ensure reported regressions are free from variance inflation, non-linearity and non-normality.

[2] *** Significantly different from zero at the 1% test level; ** 5% level; * 10% level.

[3] For charcoal regressions, inventory values are measured in 1,000s; for timber regressions, in 100,000s.

[4] Middlemen were combined with trader category for all models due to limited incidence of bribe or tax payment in these categories.

[5] Tests of the hypothesis of no interdependence between bribes and taxes can be conducted using either a t-test or likelihood ratio test. The t-value for the estimates of ρ are 4.46 and 3.09 in the charcoal and timber regressions, respectively, which exceed the 1% critical value of 2.58; this allows us to reject in both cases the null hypothesis that ρ=0. The likelihood ratio test is constructed using likelihood values from the univariate and the

bivariate models as $2 \times [(L_B + L_T) - L_{B,T}]$. The test statistic equals 23.9 for the charcoal data and 10.1 for the timber data. Both are large enough to allow us to reject the null hypothesis of no interdependence at the 1% level, against the χ^2 (1) test statistic of 6.63.